ON SCENE

THE NATIONAL MARITIME SAR REVIEW

DEPARTMENT OF TRANSPORTATION
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SURVIVAL TIME

A couple of recent cases have shown that the survival time of a person in the water is difficult to determine. In a case off St. Joseph, MI last October one man who stayed with his overturned boat survived for 24 hours and was rescued; the water temperature was 56 degrees. The graph in the SAR PLANNER (Ninth CG District) which is taken from the National SAR Manual indicates that an average person could be expected to survive only 5 or 6 hours. The other two men who were in the boat attempted to swim to shore, but did not survive. In another case this winter, a man who fell from the breakwater in Muskegon did not lose consciousness, although his body temperature was 80 degrees when he was rescued.

The important thing to remember here is that the SAR PLANNER graph times are AVERAGES only and are to be used for planning. They are not absolute survival times. In view of this, RCC will often continue a search well beyond the graph times. Individual search units must be aware of this and not let down in their search effectiveness. Remember, as long as we're searching, let's do it right. A poorly conducted search isn't much better than no search at all.

Editor's Note:

This article was taken from the CCGD9 SAR Newsletter 6/76. It's original title was "Exposure". The item calls to mind two very important points about maritime SAR and survival:

a. While tables and graphs of survival times can assist in evaluating the wisdom of terminating a search, they should not be used as absolute controlling factors. The guy or gal you're looking for may be one of those above average characters.

b. When you are dumped into cold water, the exertion of swimming, drown-proofing or treading water will bring on hypothermia quicker than if you can stay afloat without exertion.

Our thanks to the SAR team in the Ninth District for these examples.

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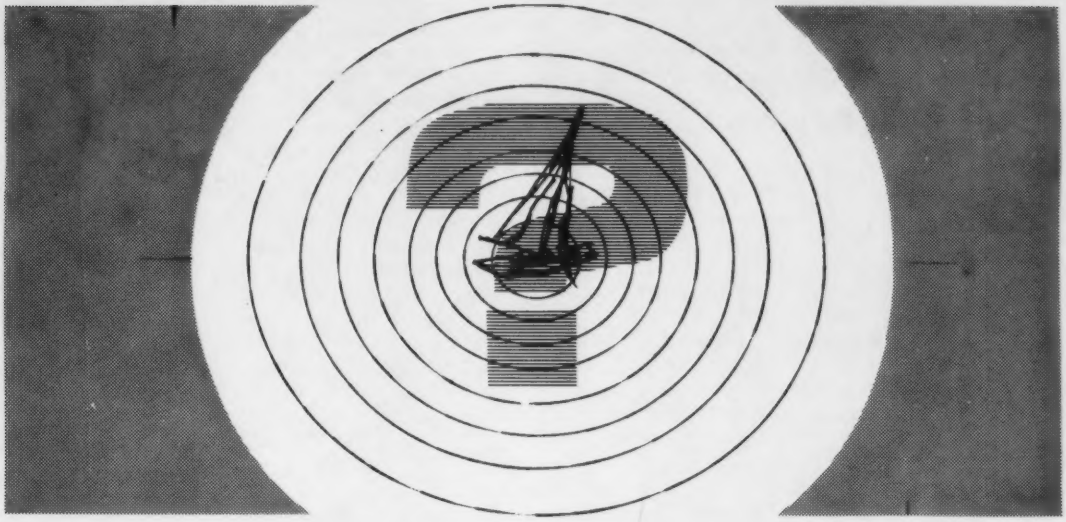
YACHTS USE EPIRBs MORE



Evidence is mounting that the use of emergency position indicating radio beacons (EPIRBs) by sea-going yachts is on the increase and that their use by these craft is probably one of the most successful uses of the device, both for alerting and for locating. Previous issues of ON SCENE (Issue 4-74 and Issue 6-75) have carried articles on this subject. This present article will summarize the cases described therein and four additional cases which have occurred within recent months.

SAILING VESSEL TRIUMPH

On 20 October 1973 New York Ocean Area Control Center notified New York RCC that an aircraft transitting offshore between New York and Bermuda had heard an EPIRB signal on frequency 121.5 MHz. This and five subsequent reports yielded a rough fix. A Coast Guard HC-130 aircraft then located the sailing vessel TRIUMPH disabled within about thirty miles of the rough position. Surface assistance was dispatched and the vessel was escorted and towed to Rockaway, New York.

SAILING VESSEL ROBIN II

On 2 July 1974, New York Ocean Area Control Center again received numerous reports from commercial aircraft of an EPIRB signal heard on 121.5 MHz. Again a rough position was obtained from these reports and an HC-130 aircraft was dispatched from Elizabeth City. The aircraft located the sailing vessel ROBIN II which had a broken mast, was underway on auxiliary engine, but had only enough fuel remaining for about twenty more hours of steaming. The CGC VIGILANT then rendezvoused with the ROBIN II and transferred fuel to her and escorted her to Newport, Rhode Island.

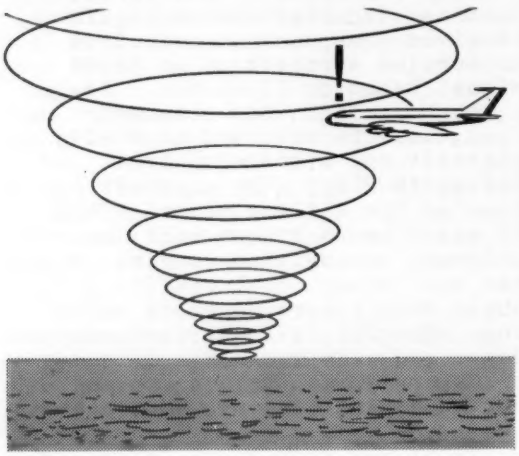
SAILING VESSEL BANJO

On 26 July 1975 EPIRB signals were again reported to New York Ocean Area Control Center by transitting aircraft. An HC-130 aircraft, using aural homing techniques was able to locate the source of the signal shortly thereafter, the sailing vessel BANJO. The BANJO had suffered severe

structural damage in a storm and was taking on water. She did not have any communications capability other than the EPIRB which was activated. A merchant ship was diverted to pick up the three survivors and the BANJO later sank.

SAILING VESSEL COLUMBIA

On 29 July 1975 an airliner, inbound to Honolulu from the United States, reported hearing an EPIRB signal on 121.5 MHz. An HC-130 from Coast Guard Air Station, Barbers Point flew outbound attempting to locate the source of the signal. The aircraft closed on the EPIRB by aural homing methods and eventually picked up the signal on the direction finder. The EPIRB signal was coming from the sailing vessel COLUMBIA which had lost her rudder and was unable to proceed. She had no communications capability except the EPIRB. A Coast Guard Cutter was dispatched from Hawaii to tow the COLUMBIA into port.



SAILING VESSEL RAINBOW

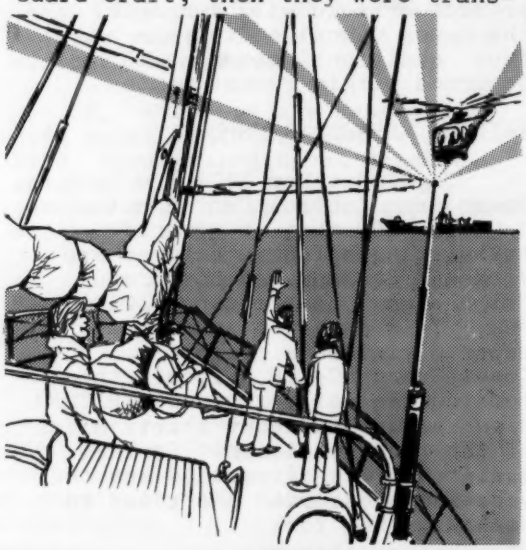
On 12 November 1975 a Navy aircraft, when responding to an EPIRB signal, located the sailing vessel RAINBOW taking on water. The vessel, a thirty-eight foot trimaran was flooding in the center and port pontoon. Aircraft stood by until a Coast Guard cutter arrived on scene to tow it into port. Again the vessel had no radio other than the EPIRB which was credited with the save in this case.

SAILING VESSEL MAYA

On 2 June 1976 New York RCC received reports from transitting aircraft of an EPIRB signal on 121.5 MHz. Again an HC-130 aircraft from Coast Guard Air Station Elizabeth City located the source, the sailing vessel MAYA. When surface assistance arrived they discovered the crew wet, cold, exhausted, disoriented and without operable navigation equipment or radio. The vessel had been bound from Little Creek, Virginia to the Virgin Islands. It was escorted safely to Cape May, New Jersey.

SAILING VESSEL WINDEMERE

On 14 June 1976 New York RCC again received reports of EPIRB signals offshore. While Coast Guard aircraft were searching for the source of the signals, a merchant vessel, attracted by visual flares, found the sailing vessel WINDEMERE which had been dismasted and disabled. This proved to be the source of the EPIRB signals. The persons onboard were temporarily taken aboard the merchant vessel until the arrival of Coast Guard craft, then they were trans-



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Computer Assisted Search Planning (CASP)

By J. A. White, LCDR, USCG

Present search planning methodology, as outlined in detail in the National Search and Rescue Manual, requires the estimation of certain parameters describing the incident, environmental conditions, and survivor craft location. In each of the estimations made, a best estimate of each item of data is required. The best estimates for these parameters correspond to conditions "most likely" to exist on scene or during the search. In some cases called "minimax", two estimates for a particular data item are used. Then the problem is solved twice, once for each estimate. Since all of these estimates may have errors, an attempt is made to account for them. The errors are combined to produce a value for "total probable error of position". It is this value which is used to compute size of the search area. This method of solving a problem is referred to as a "determinate" method.

In all cases where a determinate solution is used, the data is subject to error. What if a certain data item is not the best estimate? If this data item is changed and the problem is solved again, the new answer should be different from the old one. If there is a high probability that a given data item has a specific value, then the corresponding solution is more accurate than one based on a less likely data value. If this procedure is repeated many times, varying all of the data values according to their respective probabilities, the result will be a large number of solutions to the same problem, most having different values. These solutions can be grouped and tallied according to their values. These groups will then indicate in what range the true answer most probably lies, and they will also show the likelihood that each of the other ranges may include the true solution. This method of problem-solving is called "simulation".

ABOUT THE AUTHOR:

LCDR James A. White is presently serving as Chief, Operations Analysis Branch, Coast Guard Atlantic Area. He holds a Master of Science degree in Management from the U. S. Naval Postgraduate School, and a Bachelor of Science degree in Engineering Science from the U. S. Coast Guard Academy. He has been associated with Search and Rescue problems while assigned to the USCGC COOS BAY as a deck watch officer and the USCGC CAPE HORN as commanding officer, and while serving as an instructor in the Professional Studies Department at the Coast Guard Academy. While assigned to Commander, Atlantic Area, LCDR WHITE has worked on the development of the Search and Rescue Planning (SARP) System and the Computer-Assisted Search Planning (CASP) System. Previously, he co-authored an article titled "An investigation of the Repeated Expansion Search Concept" which was published in the May, 1973 issue of ON SCENE.

CASP is a series of computer programs which use the simulation method to help solve the search planning problem. The acronym CASP stands for computer-assisted search planning. The computer is used to relieve the SAR planner of much of the heavy load of hand calculation traditionally required for effective search planning. Because of its speed, the computer permits more accurate calculation of many quantities, such as target position uncertainty which heretofore could be dealt with only by rules of thumb.

The word " assisted" is used to indicate that CASP is a search planning aid, or tool, intended to help the search planner do his job--it does not do it for him. There remains ample opportunity for the search planner to apply his own special knowledge and experience in the formulation and updating of the search problem. It is hoped, however, that much of the tedium of search analysis has been removed, so that more time can be devoted to the thought process which is so essential to effective search planning.

The words "search planning" in CASP need no special explanation. It should be noted, however, that we are not talking about all of the aspects of search planning which must be considered. The output of CASP is a sequence of probability maps specifying the most probable locations for the target during the course of the search operations. These maps take into account the factors surrounding the target's distress or disappearance, the kind and quality of search effort previously expended, and the dynamic influence of sea currents, wind and leeway.

The development of CASP began in 1970 when Wagner Associates, an operations research firm located in Paoli, Pennsylvania, was asked by the Coast Guard Office of Research and Development to assist them in developing a computerized approach to search planning. Previously, Wagner Associates had primary responsibility for the operations research work carried out during the Mediterranean H-bomb search in 1966 and during the five month search for the nuclear submarine Scorpion in 1968. During this latter search, computers ashore were used extensively to support and augment search analysis at sea. In both of these searches, there were many clues about the target's location but no really solid pieces of information.

LT SMITH, Operations Analysis Branch, CAA reviews a CASP map with LT CORNELL, CCGD3 RCC Controller, in planning a search for an overdue vessel.

In the case of the lost H-bomb, the clues consisted of the locations of three of the four weapons, aircraft wreckage on land and at sea, the location of crew members who parachuted to safety, and eye witness accounts. However, much of this information was contradictory. In order to provide a meaningful basis for search it was decided to

assign a weight to each explanation for where the missing bomb might be located. Each explanation or scenario determined a probability map for the targets location and the overall probability map was based on a combination of the individual scenario maps. A similar weighted scenario approach was used in the five-month search for the nuclear submarine Scorpion.

The development of CASP was completed in mid-1971 and turned over to Coast Guard Headquarters for extensive testing and evaluation, including comparison of results with historic SAR cases. Following this, the programs were provided to COMLANTAREA for operational testing and evaluation, and for modification for use on the SARLANT/SARPAC teletype networks. Many improvements were introduced along the way by Coast Guard personnel and the CASP programs, as they exist today, truly represent a team effort. CASP was implemented throughout the Coast Guard in March 1974, following a one-week training course for senior RCC controllers.

The objective of the CASP System is to provide rescue coordination centers with a method for (1) calculating probability maps for target location at the time of the distress incident, (2) updating these maps to take into account target motion due to wind and sea current effects, (3) update these maps for previous search efforts, and (4) optimizing the allocation of existing search resources. More specifically, the CASP system provides RCC controllers with a method for describing, in quantitive terms, the uncertainty in target location at the time of the distress incident and provides a means for estimating the likely areas for target location at any subsequent time.

Probability maps are used to quantitatively represent the uncertainty in the target's location. These maps associate a probability with each grid cell. This probability represents the fraction of times the target would be located in that particular grid cell if the identical distress incident were repeated a large number of times.

The CASP system makes use of computer simulation to produce probability maps for predicted target locations. The specific method of simulation is generally referred to as "monte carlo", since random numbers are generated in order to determine the direction and speed of the target in cases where the estimates of winds and sea currents are uncertain. Thus, the target location is determined by an experiment depending upon chance. This experiment is repeated numerous times in order to develop a distribution of points which represent all possible target locations. Each point in the distribution has an associated weight which indicates its credibility. The probability that the target is located in a particular grid cell is obtained by adding up all of the weights associated with points which fall in that grid cell.

The CASP programs which produce the initial probability distribution of possible target locations at the incident distress time are refered to as the "generation" programs. There are three generation programs, POSITION, TRACKLINE, and AREA, each of which describe a possible incident scenario. More specifically, the generation programs are used to produce a computer file called the target triplet file consisting of latitude and longitude of all possible target locations and the associated weight for each possible location. Each record in the file represents one outcome of the computer simulation.

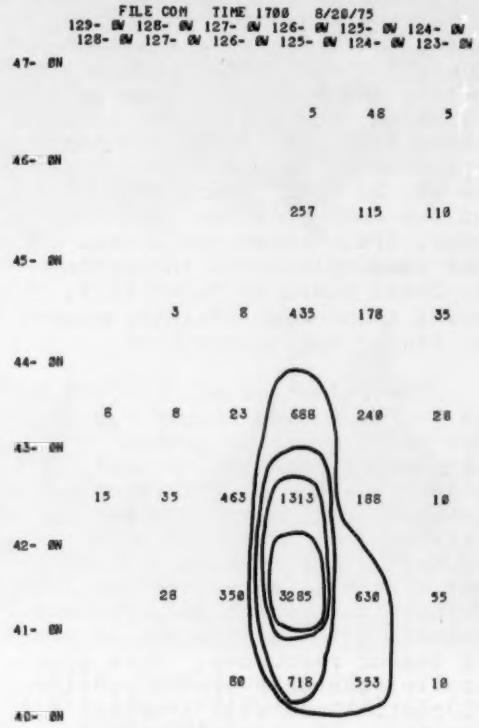
Program DRIFT updates each point in the triplet file for target motion due to the effects of wind and sea current. The DRIFT program will access a computer file for wind and sea current data, unless this information is provided by the search planner. The computer will also calculate estimates

of uncertainty associated with both the wind and sea current vectors. Random numbers are generated to simulate errors in the various parameters and a vector is computed for each point in the distribution. The target latitude and longitude is then updated for its new position as a result of the simulated drift. After each drift increment, the tables are consulted to obtain vectors for the target's new location. The process is than repeated until the target drift has been simulated for the entire drift period. This procedure is repeated for each point within the target probability distribution.

Weather data is input to the computer to update the computer environmental data files accessed by the CASP drift programs.

The search correction programs, PATH and RECTANGULAR, update the target probability distribution to take into account negative search results. The effect of this update is that the probability of a target location is reduced in areas of unsuccessful search and raised in areas which were not searched. Each program creates a probability detection function. The values of this function specify the probability that if the target was located in the search area, then it would have been detected during the search conducted. These programs assume that the target is stationary for the entire search period.

CASP is a new tool for the RCC controller. The end result of all of the above CASP features is a powerful and flexible search planning system which, because of its unique and comprehensive nature, actually includes the search planner. The search planner is a necessary and crucial part of the system because he must carefully evaluate and attach statistical weight to all the various data he has collected. This requirement, in itself, forces the search planner to use a more concise and organized approach to handling all the distress information available.



The above CASP map shows the probability distribution of a combination of two position programs. (NOTE: The contour lines are drawn in by hand.)

There are two cardinal rules that should be followed when developing initial CASP scenarios. The first is "NEVER DISCARD ANY INFORMATION". No matter how insignificant a clue may seem, it can and must be included. The system is

designed to include all possibilities. Secondly, "NEVER DO IT ALONE". Any complex case completed by an individual will be biased towards that search planner's point of view.

CASP has proven that there is more to good search planning than plotting a search area on the chart and dispatching resources to cover the area. There must be a careful thought process, if we are to obtain maximum benefit from our search effort.

CAN YOU RECONSTRUCT THAT SAR CASE?

In a considerable number of instances where allegations of improper response or other failings during SAR operations have been made against a Coast Guard unit, the unit has been unable to reconstruct the events related to the situation. This indicates that some units are not keeping enough of a record to:

(a) Complete the Incident Processing Form required by paragraphs 714 and 715 of the National SAR Manual (CG-308) for all units with a primary task of SAR; or

(b) Fill out a SAR Incident Summary (Form CG-4612) as required by the SAR Reports Manual (CG-397); or

(c) Are not retaining the information on SAR cases for the five years required by the Paperwork Management Manual (CG-416), Appendix A for SAR case files.

Since logs are no longer required at shore units, it is essential that shore units document their SAR operations in accordance with existing directives. A unit may be expected to produce the documentation in any of the following instances:

(1) A SAR Case Study or SAR Case Narrative is required;

(2) A Board of Investigation is convened to look into some aspect of the operation.

(3) Allegations about the case are received;

(4) Legal proceedings involving the case are instituted.

It is a good idea for those in a position of responsibility to review the adequacy of your local documentation to see if it could respond properly to these demands for SAR Case documentation.

YACHTS...Contd from page 4

ferred and the boat was taken in tow and towed safely into port.

SAILING VESSEL JAN

On 13 July 1976 four commercial aircraft reported hearing EPIRB/ELT type signals approximately 360 to 400 miles ESE of New York. Two HC 130 aircraft investigated and located the JAN, a trimaran, capsized with one survivor. A merchant vessel was diverted and rescued the survivor and sole occupant.

MEANING FOR THE FUTURE

These cases demonstrate that for sailing yachts the EPIRB has become a very important piece of emergency equipment and that search and rescue forces must be aware of the widespread carriage of EPIRBs by sea-going yachts. These cases also demonstrate that an EPIRB heard over water must be taken seriously as a potential surface vessel distress case as well as a possible ditched aircraft case.

By CWO W. K. Collier

41' UTB LIFE RAFT

There are presently several different "brands" of these 4-man life rafts in service, depending on which manufacturer was awarded the contract at the time. The rafts are however all packaged in moisture proof rigid containers which are equipped with "moisture indicators". These indicators should be closely monitored and any raft found to contain moisture removed from service and unless otherwise directed, sent to the manufacturer's nearest inspection and repair facility for inspection and resealing. This should be accomplished as soon as possible as moisture will rapidly deteriorate and render a raft and it's equipment unreliable.

The specification for the raft is presently being revised in an effort to improve and provide for a more standardized raft in the future. Also being developed are detailed maintenance and inspection requirements for the raft.

STOKES LITTERS & FLOATABLE DROP PUMPS

Whenever I visit units in the field I can almost always count on finding discrepancies with these two items. The most common discrepancies found with the Stokes Litter are no ballast bar, no chest pad, improper hoisting sling and hoisting slings on aluminum litters. Commandant Instruction 3130.11F requires that all Stokes Litters used to transport a person on or over the water be equipped with flotation material and a ballast bar. Hoisting slings are only required on litters that are intended for power hoisting and should never be installed on aluminum litters.

The most common discrepancies found with the Floatable Drop Pump are corrosion and missing equipment. The Floatable Drop Pump, like any other pump, has to be properly maintained if it is to be depended on. Instructions for maintaining the pump are contained in the Naval Engineering Manual, CG-413 and the Aviation Life Support Systems Manual, CG-429.

SHARK REPELLENT

There is a possibility that the chemical shark repellent packets may soon be deleted from service. Reportedly the Defense General Supply Center has been requested to discontinue purchasing the packet as it is not always effective in repelling sharks. The unofficial word I received however, is that they (DGSC) will probably continue to stock the repellent until someone positively proves that is is ineffective in all cases or until a suitable replacement is available. As there is no suitable replacement presently available this could take a couple of years.

The most probable replacement for the chemical shark repellent is a barrier-type device called a Shark Screen, which has been developed by the Naval Undersea Center. The device looks like a large leaf bag with an orally inflated collar at the top. When not in use the device will be folded up in a small package and carried like the chemical repellent. To use the device you unfold it, inflate the collar and then climb inside. Once inside you then completely fill the bag with water

by pushing down on the collar and scooping water into the bag. From the outside, the underwater portion of the device will then look like a large, solid-looking, bulky object, which conceals dangling arms and legs and also retains blood and other substances likely to stimulate a shark attack.

Tests of the Shark Screen have been favorable. However, the materials tested thus far have not permitted production of a package that is sufficiently small to be included in current survival gear.

AMENDMENT TO ANNEX 12

The International Civil Aviation Organization has issued Amendment 12 to Annex 12 - Search and Rescue to the Convention on International Civil Aviation. The amendment adds a recommended practice which provides that the usual means of communication of meteorological offices with rescue coordination centers and with rescue sub-centers should be supplemented, as and where necessary, by other means of visual or audio communication, for example, closed circuit television.

The date of applicability of the amendment is 12 August 1976.

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